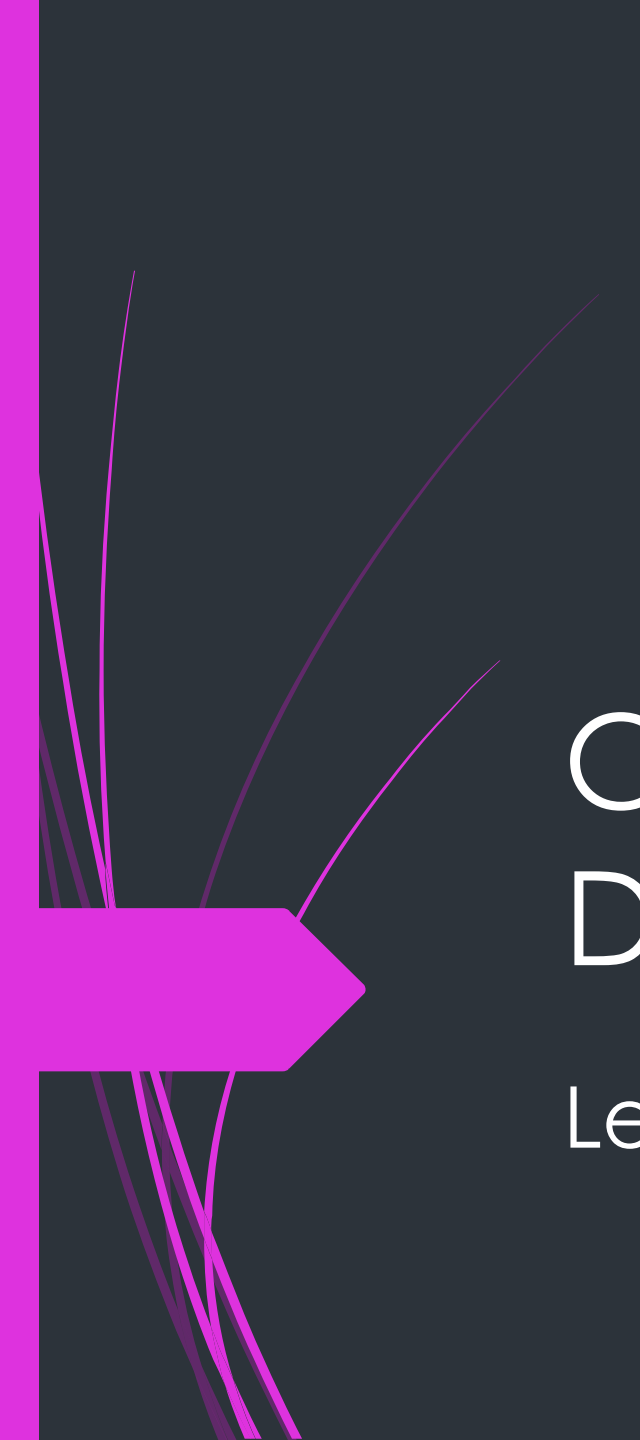




CSE 2102 - Database Systems Design and Information

Lecture 7 : Logical Database Design



Database System Design

- Requirement Analysis
- Conceptual Database Design
- Logical Database Design
- Schema Refinement
- Physical Database Design
- Security Design



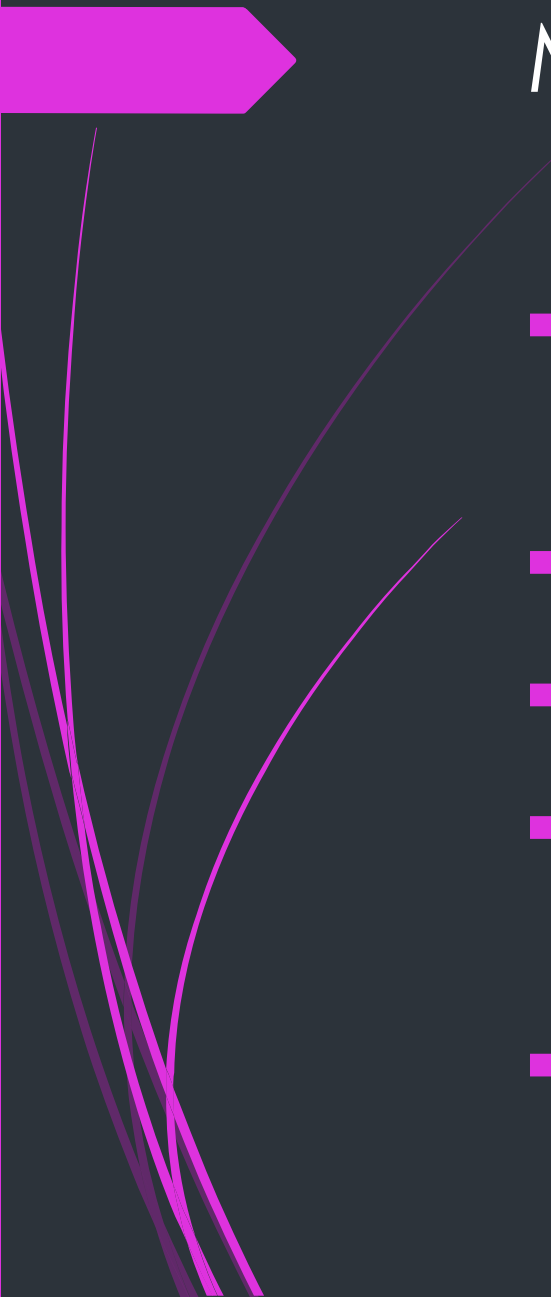
Logical Database Design

- The third step in the Database Design stages involve:
 - Choosing a DBMS to implement our database design
 - Convert the conceptual database design into a database schema for the chosen DBMS



Selecting a DBMS

- Several things to consider:
 - Your data model
 - Availability of support
 - Your budget
 - Features
 - Security
 - API support to your front end
 - Device/Platform support
 - Backup/restore functions
 - Crash recovery/data recovery
 - Multi-user?



MySQL

- According to MySQL.com., “the world’s most popular open source database...”
- RDBMS
- Popular choice for websites and web-applications
- Popularly distributed in development environment e.g. LAMP, WAMP, XAMP etc.
- Popular web-application: Wordpress, Joomla, Drupal, etc.



MySQL GUI

- Supported by many GUI tools:
 - PhpMyAdmin (www.phpMyAdmin.net) “A tool written in PHP intended to handle the administration of MySQL over the WWW”
 - Official GUI Tool: MySQL Workbench
 - SQL Development
 - Administration
 - Database design, creation, maintenance, etc.
- Command-line interface and tools



MySQL Features

- Cross-platform support
- Supports Stored Procedures
- Triggers
- Independent Storage Engines:
 - **MyISAM** – speed
 - **InnoDB** - for transactions and referential integrity
 - **MySQL Archive** – storing data in little space
- Query caching
- Full text indexing
- ACID compliance
- Cloud Computing platform support



Data Types

- Data Type?
 - Classification of the data (type)
 - Determines the possible values of the data field (indirectly enforces data integrity)
 - Can be numeric, character string, bit variable (Boolean), etc.

MySQL Data Types - Integers

➤ INT

- -2147483648 to 2147483647
- Unsigned range is 0 to 4294967295

➤ TINYINT

- -128 to 127
- Unsigned range is 0 to 255

➤ BIGINT/SERIAL

- -9223372036854775808 to 9223372036854775807
- Unsigned range is 0 to 18446744073709551615

MySQL Data Types - Decimal

- DECIMAL [M, D]

- M – maximum is 65 digits* (if not specified the default is 10)

- D – maximum is 30 (if omitted the default is 0)

- Example:

- Salary DECIMAL[6,0]

- Price DECIMAL[4,2]

- Savings DECIMAL[38,30]

MySQL Data Types - Float

- `FLOAT [M, D]`

- $-3.402823466E + 38$ to $-1.175494351E - 38$,

- $1.175494351E-38$ to $3.402823466E+38$

MySQL Data Types – DATE/TIME

- DATE

- YYYY-MM-DD e.g. 2012-10-02

- TIME

- HH:MM:SS e.g. 13:55:23

- DATETIME

- YYYY-MM-DD HH:MM:SS

- e.g. 2012-10-02 13:55:53

- YEAR

- YYYY

MySQL Data Types - Characters

- CHAR

- CHAR(M) where M can be 0 to 255

- E.g. name CHAR(24)

- VARCHAR

- VARCHAR(M) where M can be 0 to 255

- E.g. name VARCHAR(24)

- Difference between the two?

- Name VARCHAR(10), name = "Tom"; stored as 'Tom'

- Name CHAR(10) , name = "Tom"; stored as 'Tom'

MySQL Data Types – TEXT, BLOB

➤ TEXT

- TINYTEXT 256 bytes

- TEXT 65,535 bytes ~ 64 kb

- MEDIUMTEXT 16,777,215 bytes ~ 16MB

- LONGTEXT 4,294,967,295 bytes ~ 4GB

➤ BLOB – Binary Large Object

- Storing files – images, documents, etc

MySQL Data Types - ENUM

- ENUM – Enumerated Data Type
 - A string object that can have only one value, chosen from the list of values 'value1', 'value2', ..., or NULL
 - Can have a maximum of 65535 distinct values
- Example:
 - `ENUM roomType('standard', 'deluxe', 'presidential')`
 - `ENUM title('Mr.', 'Mrs.', 'Dr.', 'Ms')`



Preparing the Database Schema

- This is where you specify the data type for the attributes of each entity identified in the Conceptual Database Design stage of database development
- The data type must be specific to the chosen DBMS software to implement your database solution



Scenario

- Small guest house with two rooms. Simple database to track income and guests
- Entities:
 - Guests: id, name, telephone
 - Rooms: id, number, price, description
- Relationship:
 - Stayin: id, checkin, checkout

Example

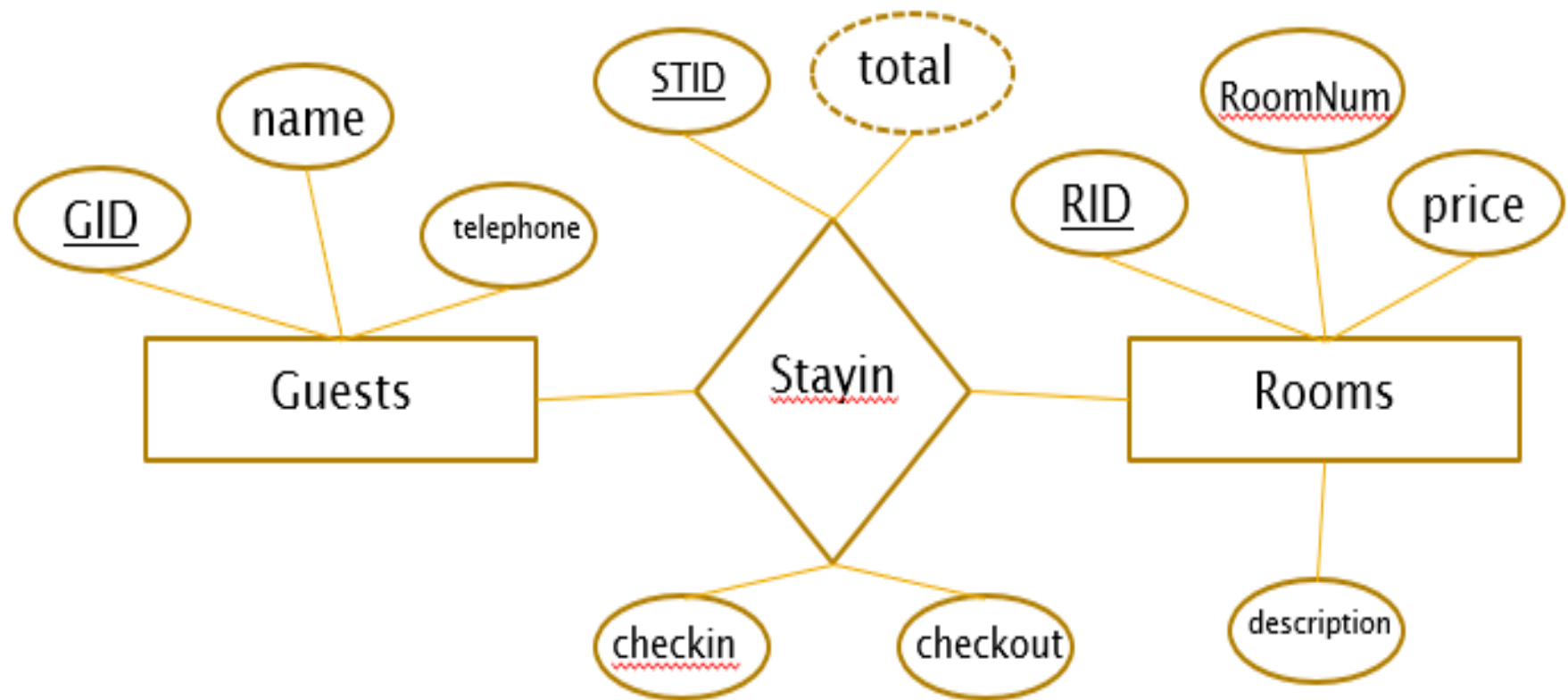


Table Mapping - Relations

► Guests

<u>gid</u>	Name	telephone
11	Frank	555-5656
12	John	555-7878
14	Sasha	432-2323

► StayIn

<u>stid</u>	<u>gid</u>	<u>rid</u>	<u>checkindate</u>	<u>checkoutdate</u>	total
1011	11	1	2011-03-12	2011-03-15	15000
1012	12	2	2011-03-23	2011-03-25	16000
1013	14	2	2011-04-23	2011-04-27	32000

► Rooms

<u>rid</u>	<u>RoomNum</u>	Price	description
1	101	5000	...
2	102	8000	...



Selecting Data Types

➤ Guests

- gid: int(6) (range from 1 to 999999)
- name: VARCHAR(24)
- telephone: VARCHAR(10)

➤ Rooms

- rid: int(3) (range from 1 to 999)
- roomNum: int(3)
- price: decimal(6:0)
- description: text



Selecting Data Types cont.

- StayIn

- stid: int(10) (range from 1 to 9999999999)

- checking: date

- checkout: date



Database Schema

- Guests(gid: int(6), name: varchar(24), telephone: varchar(10))
- Rooms(rid: int(3), roomNum: int(3), price: decimal(5:2), description, text)
- StayIn(stid: int(10), rid: int(3), gid: int(6), checkin: date, checkout: date)

Relational Database Terms

- ▶ Degree – Total columns in a relation
- ▶ Cardinality – Total records in a relation

Formal Terms	Alternative A	Alternative B
Relation	Table	File
Tuple	Row	Record
Attribute	Column	Field



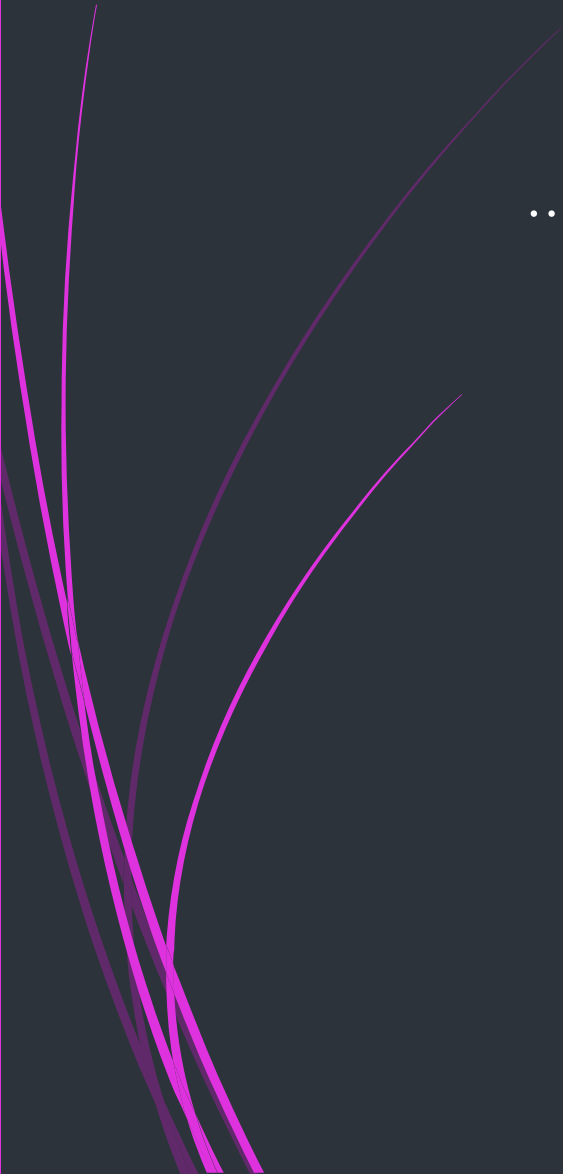
Conclusion

- Logical Database Design is the process of mapping the fields (attributes) and deciding on appropriate data types (specific to the DBMS of choice)
- Selecting a data type is based on
 - The DBMS specifications
 - Smart use of space
 - Suitability



Questions?

...



References

- <http://www.edm2.com/0612/msql7.html>
- <http://www.readwriteweb.com/enterprise/2009/02/is-the-relational-database-doomed.php>
- Website source (taken Sept 29th 2012): <http://en.wikipedia.org/wiki/MySQL>
- Website source (taken Sept 29th 2012):
<http://www.ibm.com/developerworks/webservices/library/ws-dbpick/index.html>
- MySQL Reference web source (taken Sept 29th 2012):
<http://dev.mysql.com/doc/refman/5.0/en/data-types.html>



July 2026

Appendix XXXII : Local Clearing Code

To ensure correct routing of payments through domestic clearing systems, a clearing code is required for certain currencies when sent to the local country (Ex : sending USD to the US).

Local clearing codes must adhere to a specific structure in both MT (MT101/MT103) and MX (pain.001/pacs.008) formats. In MX, a specific code must be used in the <ClrSysId><Cd> field, and the bank's alphanumeric ID must be included in the <ClrSysId><Mmbld> field.

Below is a summary table outlining the countries concerned, the codes used in MT, the codes to be used in MX, and examples for illustration purposes.

Country code and currency	Name of local clearing code	Code in MT	Example in MT (field 57)	Code in MX	Example in MX (tag <FinInstnId>)
AU / AUD	Australian Bank State Branch (BSB) Code	AU	AU 123456	AUBSB	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> AUBSB </Cd></ClrSysId> <Mmbld> 123456 </Mmbld> </ClrSysMmbld> </FinInstnId>
CA / CAD	Canadian Payments Association Payment Routing Number	CC	CC 123456789	CACPA	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> CACPA </Cd></ClrSysId> <Mmbld> 123456789 </Mmbld> </ClrSysMmbld> </FinInstnId>

GB / GBP	UK Domestic Sort Code	SC	SC 123456	GBDSC	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> GBDSC </Cd></ClrSysId> <Mmbld> 123456 </Mmbld> </ClrSysMmbld> </FinInstnId>
IN / INR	Indian Financial System Code (IFSC)	IN	IN ABCD5678912		<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> INFSC </Cd></ClrSysId> <Mmbld> ABCD5678912 </Mmbld> </ClrSysMmbld> </FinInstnId>
RU / RUB	Russian Clearing Bank Code / BIK	RU	RU 123456789	RUCBC	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> RUCBC </Cd></ClrSysId> <Mmbld> 123456789 </Mmbld> </ClrSysMmbld> </FinInstnId>
US / USD	Fedwire / ABA routing code	FW	FW 123456789	USABA	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> USABA </Cd></ClrSysId> <Mmbld> 123456789 </Mmbld> </ClrSysMmbld> </FinInstnId>
ZA / ZAR	South Africa local clearing code	ZA	ZA 123456	ZANCC	<FinInstnId> <ClrSysMmbld> <ClrSysId><Cd> ZANCC </Cd></ClrSysId> <Mmbld> 123456 </Mmbld> </ClrSysMmbld> </FinInstnId>

3. Canadian financial institution identification

For efficient, automated payment routing in Canada, accurate identification of the Canadian Financial Institution (FI) and its specific branch account (transit number) is crucial. To address this requirement, the targeted approach involves utilizing the **CACPA code**.

4. CACPA code

These codes are ISO 20022 clearing system identification codes used in Swift payments, identifying individual financial institutions in Canada and their respective Branch Numbers / Transit Numbers, as noted above.

The CACPA code is placed in the Clearing System Member Identification element (FinInstnId/ClrSysMmbld/Mmbld) within ISO 20022 messages, such as the Financial Institution (FI) Credit Transfer (pacs.009), Customer Credit Transfer (pacs.008) or Credit Return (pacs.004) messages, to facilitate payment routing within Canada.

For Swift payments sent to Canada, providing the CACPA code to identify a Canadian FI is recommended to ensure STP and that the payment is sent to the correct Branch Number / Transit Number and payee account.

Since the CACPA code includes both the financial institution and the specific branch account (transit number), supplementing this element with a Bank Identifier Code (BIC) or name and address is optional. Canadian financial institutions can process payments with only the CACPA code, provided it is accurate and complete.

4.1 Structure of CACPA Code

CACPA codes are a nine-digit number with the following structure:

- Structure: **0** (Leading Zero) + **III** (three-digit Institution Number) + **BBBBB** (five-digit Branch Number/Transit Number)
- Example Code: 005001722 (where Institution = 050 and Branch Number / Transit Number = 01722)

This 9-digit code provides details of the Canadian financial institution and the banking Branch Number /Transit Number where the creditor or payee's account is held.

Example:

```
<CdtrAgt>
  <FinInstnId>
    <ClrSysMmbld>
      <ClrSysId>
        <Cd>CACPA</Cd>
      </ClrSysId>
      <Mmbld>005001722</Mmbld>
    </ClrSysMmbld>
  </FinInstnId>
</CdtrAgt>
```

5. Creditor Information

In a Payment Message, the full name and address of the Creditor (payee) is mandatory under the Financial Action Task Force (FATF) Recommendation 16¹ as well as the FINTRAC² Travel Rule for electronic funds and virtual currency transfers³. Additionally, all international payments (CBPR+)

¹Payment transparency: Countries should ensure that financial institutions include required and accurate originator information, and required payee information, on payments or value transfers and related messages. This information should be structured to the extent possible and should remain with such payment or value transfer or related message throughout the payment chain.

Countries should ensure that financial institutions monitor payments or value transfers for the purpose of detecting those which lack required originator and/or payee information and take appropriate measures.

Countries should ensure that, in the context of processing payments or value transfers, financial institutions take freezing action and should prohibit conducting transactions with designated persons and entities, as per the obligations set out in the relevant United Nations Security Council resolutions, such as resolution 1267 (1999) and its successor resolutions, and resolution 1373(2001), relating to the prevention and suppression of terrorism and terrorist financing, and resolutions relating to the prevention, suppression and disruption of proliferation of weapons of mass destruction and its financing.

² The Financial Transactions and Reports Analysis Centre of Canada (FINTRAC)

³ The travel rule is the requirement to ensure that specific information (listed below) is included with the information sent or received in an EFT or a VC transfer. Information received under the travel rule cannot be removed from a transfer.

The travel rule is not a separate record keeping requirement, however, fulfilling it will help you meet your VC and EFT record keeping and reporting requirements.

EFT – travel rule

FEs, MSBs, FMSBs and casinos must include the travel rule information when they initiate an EFT for which an EFT record must be kept.

The required travel rule information for EFTs is:

- the name, address and account number or other reference number (if any) of the person or entity who requested the transfer (originator)